# POPULATIONAL ANALYSES AND NEW COMBINATIONS IN PSILOSTROPHE TAGETINA AND P. GNAPHALODES (ASTERACEAE, HELIANTHEAE)

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## ABSTRACT

Populational analyses of P. tagetina and P. villosa strongly suggest that the latter is but a regional subset of a highly variable P. tagetina; intergradation of the two taxa occurs over a broad region along their areas of contact and within any one population in such areas individuals may be found representing one or the other "species." This being so it would seem more reasonable to treat these as but intergrading allopatric varieties: P. tagetina var. tagetina, largely confined to the more western regions, and P. tagetina var. cerifera (A. Nels.) B. Turner, comb. nov., largely confined to the more eastern regions. It is further suggested that the recently described P. mexicana is but a regional, albeit tetraploid, variant of the highly variable P. gnaphalodes, and the former is so reduced in the present study.

The small genus Psilostrophe (Asteraceae), long included in the polyphyletic tribe Helenieae but now largely acknowledged to belong to the Heliantheae (H. Robinson, 1981), is mostly confined to xeric habitats of the southwestern United States and adjacent Mexico, where some of the species are common roadside weeds. The plants are usually readily recognized by their epaleate receptacles, tomentose simple leaves, herbaceous habit and bright yellow rays which persist upon the achenes. At least two of the species, P. tagetina and P. gnaphalodes, are known to be poisonous to livestock (Mathews, 1934; Kingsbury, 1964; etc.).

The genus has received several comprehensive treatments: Nelson (1903), recognized 6 species, two of these with two varieties; Rydberg (1914), recognized 10 species; Heiser (1944), reverted to a 6-species concept; and Brown (1978), largely followed Heiser's treatment but added a seventh species, P. mexicana. Brown's treatment was by far the most thorough of those listed in that he had first-hand field knowledge with most of the species, combined with considerable cytogenetical and hybridization studies (Brown 1977, 1978).

In the senior author's treatment of Psilostrophe for the Asteraceae of Mexico (Turner and Nesom, in prep.), I have had to evaluate the above contributions and in the process have come to somewhat different taxonomic conclusions with respect to the Mexican species, P. tagetina and P. gnaphalodes. A partial distribution of these two taxa, as recognized here, is shown in Fig. 1.

Brown (1978) also mapped these two species but recognized, in addition, P. villosa Rydb. and P. mexicana R.C. Brown. The senior author would place specimens referrable to the former within P. tagetina, and

specimens referrable to the latter within P. gnaphalodes. My reason for these dispositions is the subject of the present paper.

COLLECTION OF SAMPLES -- "Randersonian" type samples were made from 9 populational sites across the region of intergradation between P. villosa and P. tagetina as shown in Fig. 1 (listed below; voucher collections are by B. Turner and are deposited at TEX):

1. TEX. Jeff Davis Co.: 18 mi SE Kent (15807) - Fig. 2
2. N. Mex. Eddy Co.: 13 mi SSW Whites City (15808) - Fig. 3
3. N. Mex. De Baca Co.: 18.5 mi S of Ramon (15816) - Fig. 4
4. N. Mex. Torrance Co.: 6.4 mi ESE Encino (15817) - Fig. 5
5. N. Mex. Santa Fe Co.: 14.8 mi SE Lemay (15818) - Fig. 6
6. N. Mex. Rio Arriba Co.: 39 mi NNW Espanola (15824) - Fig. 7
7. N. Mex. Guadalupe Co.: 25.5 mi SE Santa Rosa (15830) - Fig. 8
8. N. Mex. Curry Co.: 10 mi W Clovis (15827) - Fig. 9
9. Tex. Terry Co.: 3 mi S Brownfield (15836) - Fig. 10

A "randersonian" populational sample is the type of "random sample" favored by the late Edgar Anderson (1949) for sampling plant populations effectively and efficiently. In such samples one obtains most of his individuals from a large population by rather "random collection" but also includes within the sample several or more selected individuals that, because of their rarity, might be missed by the usual sample size being gathered. From among the exactly 50 plants gathered at any one populational site in the present study, no more than 1 to 5 such selected plants were included. These were selected by the senior author; the junior authors, who assisted in the sampling, collected at "random" in ignorance of the characters concerned.

Only two characters were measured on any one plant: ligule length and pedicel length. Both of these are the so-called "key characters" which are said to distinguish between P. tagetina and P. villosa (Brown, 1978). The parts measured were taken from the apex of primary stems on mature heads (i.e., the heads were in full flower). Since the heads occur in terminal subfasciculate corymbs, the pedicels of which are of varying lengths, measurements were obtained only from those heads with longest pedicels; ligule length was measured from those same heads. All measurements were obtained from fresh (living) material and measured using a stereomicroscope (x10) and a millimeter scale (roughly measured to the 0.5 mm level).

The sample sites were selected at roughly 100 km intervals across a region of the distribution of P. tagetina which housed the occasional, if not often, "intermediatae," between P. tagetina and P. villosa (Brown, 1978; Turner, pers. obs.).

RESULTS -- Populational analyses of the 9 sites sampled are shown in the scatter diagrams depicted in Figs. 2-10. Means, standard deviations and ranges are given for the characters measured in each population, and these are arranged for comparative purposes in Figs. 11-12.

DISCUSSION AND CONCLUSIONS -- As can be seen in the scatter diagrams, there is considerable variation within and among the populations

sampled. According to Brown (1978) P. tagetina is distinguished from P. villosa primarily by its mostly longer ligules (5-14 mm long vs 3-6 mm) and longer pedicels (10-40 mm long vs 1-9 mm). Except for population 2, which occurred largely on barren gypsum deposits and clearly falls within the variation pattern of P. villosa, all of the remaining populations contained plants which might be referred to as either P. villosa or P. tagetina. As can be seen in Figures 11 and 12, all of the populations overlap to some considerable extent in the range and standard deviations of the characters measured. Indeed, it is likely that additional sampling, even within the purported range of one or the other species, would yield yet similar variation patterns. (i.e., While most individuals might fall within the variation expected, at least a few individuals would fall within or approach the variation of its allopatric cohort.) In short, the regional variation for the two characters concerned are more like those of two contiguous, intergrading varieties than it is that of two "clean" allopatric species.

Brown (1978) does not show P. villosa (= P. tagetina var. cerifera) as occurring in Mexico nor has the senior author detected such individuals. The taxon does approach the Texas-Mexico border along the lower Pecos River, but it is apparently replaced in northern Mexico by either P. gnaphalodes var. gnaphalodes or P. tagetina var. tagetina, or both. However, occasional individuals from Mexico along this border region might be assignable to var. cerifera, but I view these as but populational extremes of var. tagetina, much as occurs throughout central and eastern New Mexico, as demonstrated in Figs. 2-10.

Brown (1978) also recognized a newly described Mexican taxon, P. mexicana R.C. Brown, a reportedly tetraploid species of southcentral Chihuahua and adjacent northcentral Durango. This taxon is very closely related to the contiguous P. gnaphalodes; indeed, other than chromosome number, the principal characters which he used to distinguish between these two are more or less the same as those used to distinguish between P. tagetina and P. villosa: corolla and peduncular lengths.

Brown (1974), in his original description of P. mexicana, provided a scatter diagram to distinguish between P. gnaphalodes and P. mexicana. In his diagram, he used peduncular length (= pedicel length, as used here) along the vertical axis and disk corolla length along the horizontal axis, much as we have used to discriminate between the varieties tagetina and cerifera in the present study. He did not, however, collect populational samples for analyses; instead, his data were obtained from herbarium sheets of the purported species in which it was shown that most of the material could be discriminated by these characters (cf. his Fig. 2), although there was some overlap in the characters concerned. While he presented data for 20 individuals of P. mexicana on his scatter diagram and 15 individuals of P. gnaphalodes, only 6 of the former were shown to be from tetraploid populations. The data for P. gnaphalodes was apparently taken from herbarium sheets for which chromosome counts were not known, but his paper is unclear on this point. At least voucher sheets were not cited for the specimens graphed.

Because of our experience with the populational variability within P. tagetina we attempted to construct a scatter diagram for the Mexican material of P. gnaphalodes from northern Mexico (Fig. 13, based upon 76

sheets at LL, TEX) using the same characters (and presumably some of the same sheets) selected by Brown (1974). This includes material referrable to P. mexicana.

In any case, the results of his study are also included in Fig. 13 of the present study. It can be noted that there is a wide range of variation in the characters which are said to discriminate between the two taxa and that, taken alone, the two characters will not serve to distinguish between P. mexicana and P. gnaphalodes with certainty, nor does there appear to be any strong correlation of the characters concerned with geographical regions, as implied in the studies of Brown (1974, 1978). Rather, there appears to be a tendency for shorter peduncles and shorter disk corollas to the east, with longer peduncles and longer disk corollas to the west. Whether tetraploids are confined to the region of southcentral Chihuahua and adjacent Durango is not known with much certainty, but even so there is insufficient morphological evidence to suggest that two species are involved. Indeed, we conclude that there are but two differentiated allopatric varieties which show considerable intergradation over a broad region, much as shown for P. tagetina. Of course, if future workers can show that P. mexicana is always tetraploid and that P. gnaphalodes is always diploid and that within or near the same sites the two taxa do not effectively hybridize, then we would concede to a two-species concept. Lacking such information, we feel that nomenclatural recognition of these regionally varying populations is best accommodated at the varietal level, as indicated below.

TAXONOMIC AND NOMENCLATURAL CONSEQUENCES -- Because of the field sampling and analyses presented above, it is concluded that P. villosa is best treated as an intergrading variant of P. tagetina. So considered it must take the following name:

PSILOSTROPHE TAGETINA var. CERIFERA (A. Nels.) B. Turner, comb. nov.

Based upon Psilostrophe cerifera A. Nels. var. cerifera, Proc. Biol. Soc. Wash. 16:21.1903.

This varietal combination is occasioned by the "DeMoulin Rule" of the most recent edition of the Botanical Code (1986) which permits the recognition of automatically established tautonymic infraspecific categories.

PSILOSTROPHE GNAPHALODES DC. var. MEXICANA (R.C. Brown) B. Turner, comb. nov.

Based upon Psilostrophe mexicana R.C. Brown, Brittonia 26:115.1974.

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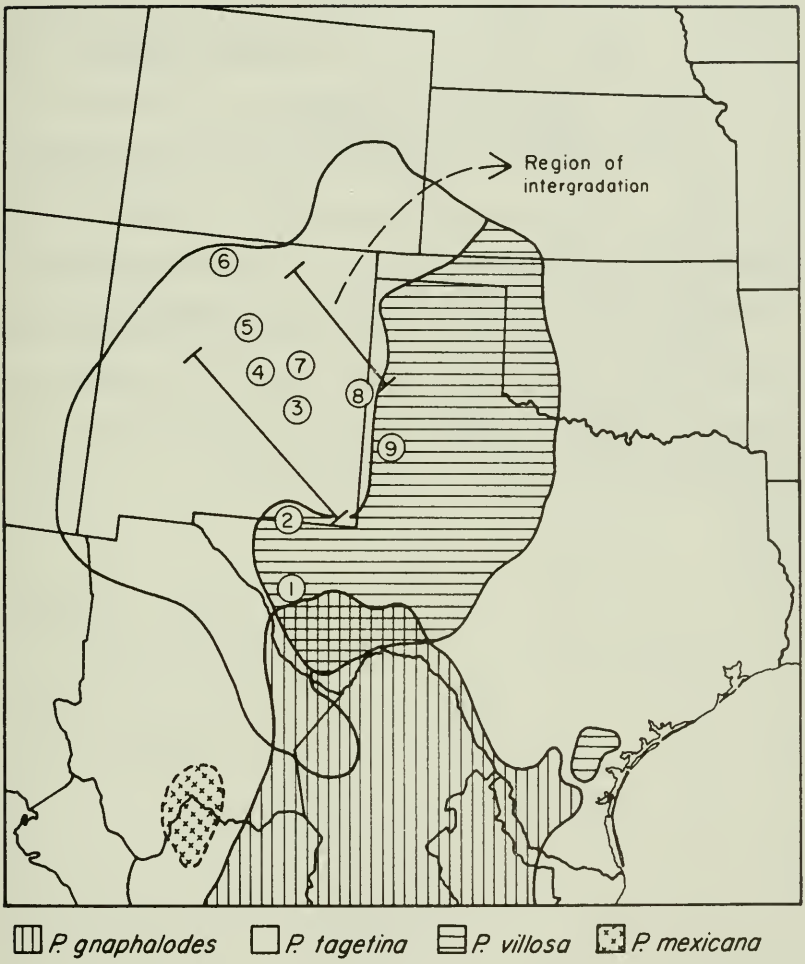


Figure 1. Approximate distribution and location of sample sites of the *P. tagetina - villosa* complex.

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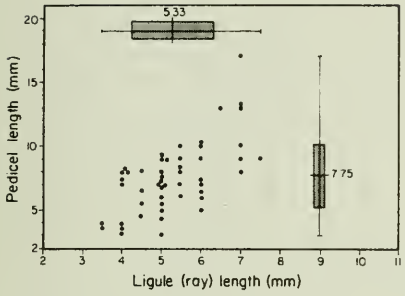
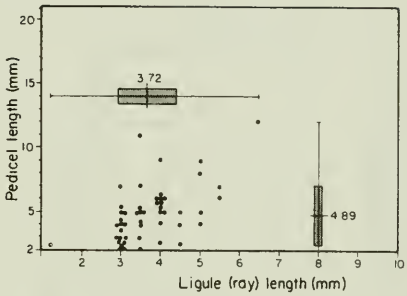



Figure 2.

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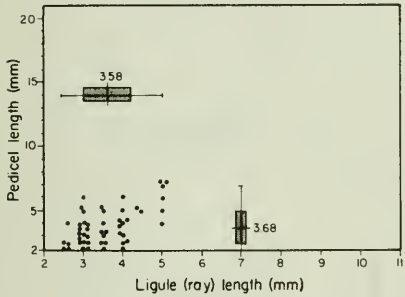


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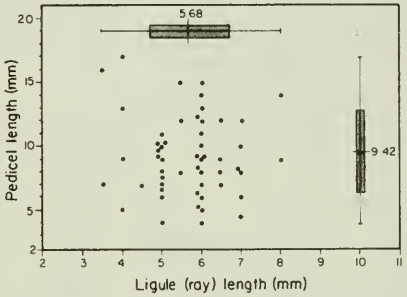


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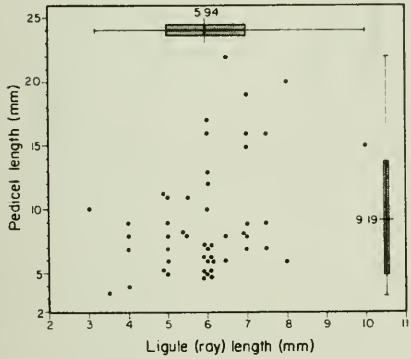


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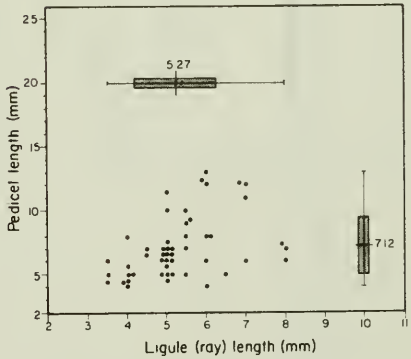


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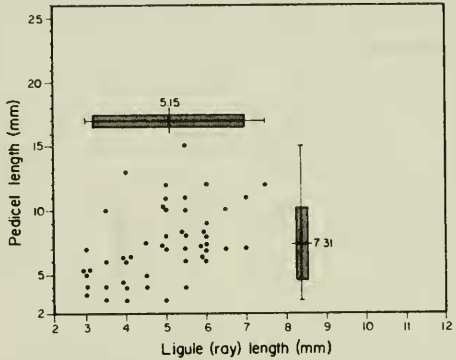


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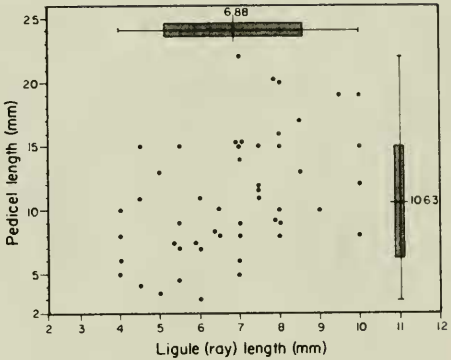


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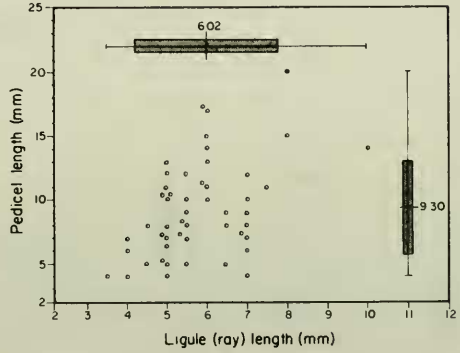


Figure 10

Figures 2-10. Scatter diagrams of 50 individuals in each of 9 populations of the *Psilostrophe tagetina-villosa* complex. Pedicel length and ray are the key characters which reputedly distinguish between the two taxa.

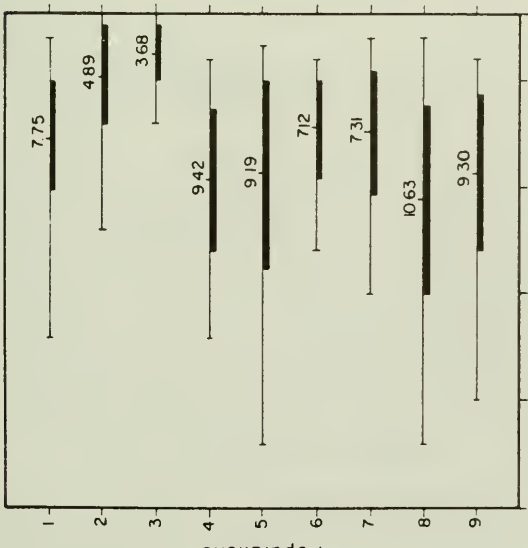


Figure 11. Mean, standard deviation and range of pedicel length of the 9 populations

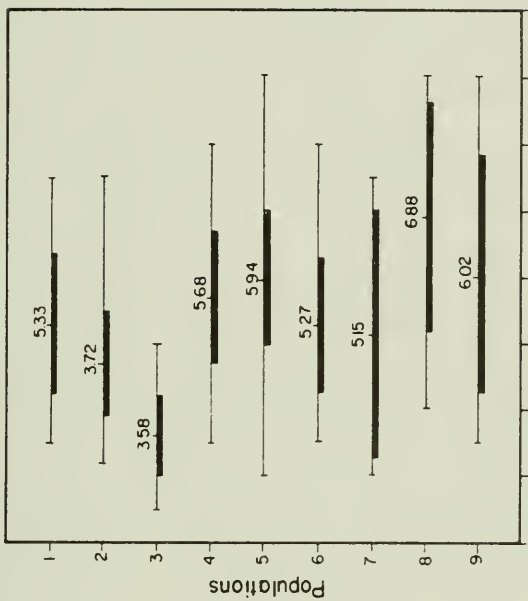


Figure 12. Mean, standard deviation and range of ligule length of the 9 populations

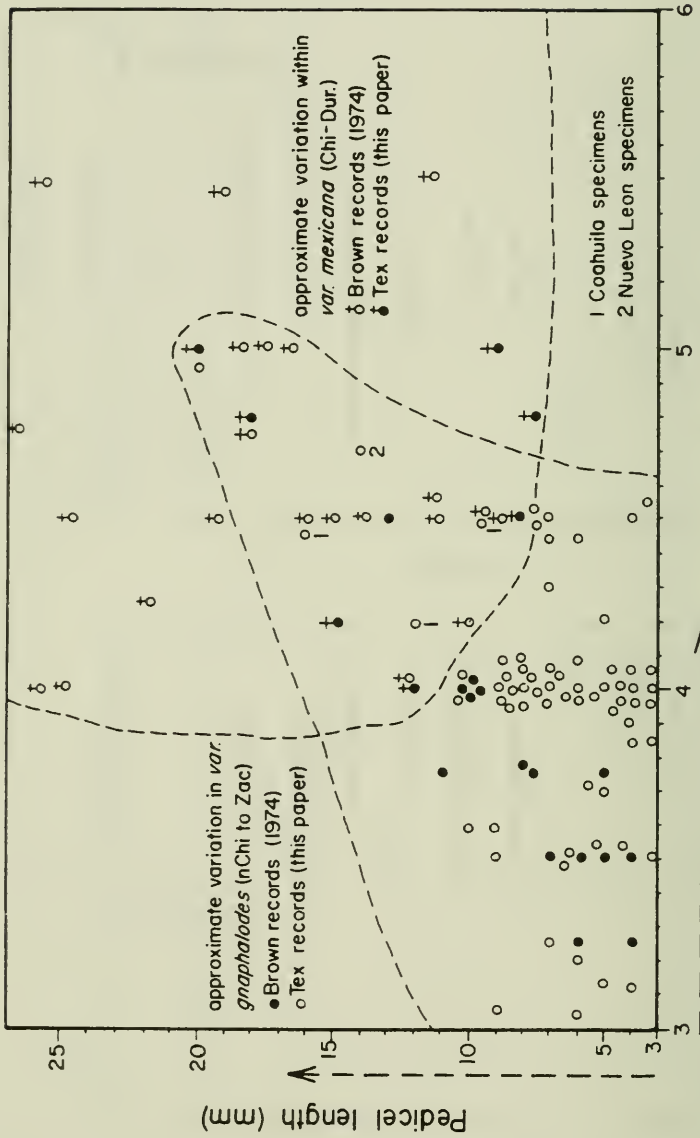


Figure 13. Scatter diagram of var. *mexicana* and var. *gnaphalodes*